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RESEARCH PAPER

Incidence of chickpea pod borer and monitoring of pod borer moths by using pheromone traps

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Abstract : Present study was carried out on chickpea to find out the incidence of pod borer as well as monitoring of pod borer at Pulses Research Station, Junagadh Agricultural University, Junagadh (Gujarat) during *Rabi* seasons 2011-12, 2012-13 and 2013-14. The results revealed that larval population of *Helicoverpa armigera* was varied from 0.86 to 2.55 larvae/mrl at 30 DAS. More or less similar pattern was observed at 45 and 75 DAS, while larval population varied from 1.45 to 3.20 and 1.26 to 3.02 larvae/mrl, respectively. At 60 DAS treatment D_2V_1 noted lowest larval population (0.58 larvae/mrl). The treatment D_1V_3 recorded the lowest pod damage of 3.66, 3.95, 4.03 and 3.88 per cent in 2011-12, 2012-13, 2013-14 and pooled results, respectively. Seed yield was varied from 825 to 1612 kg/ha. The activity of male moths began from 50th standard week of December to 9th standard week of February / March. The peak period was observed from 1st standard week to 4th standard week of January.

Key Words : Chickpea, Gram pod borer, *Helicoverpa armigera*, Incidence, Monitoring

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INTRODUCTION

Chickpea (*Cicer arietinum* L.) belongs to *Fabaceae* family, cultivated in many countries of the world and comprises 20 per cent of the world legumes production. It also known as Bengal gram or gram, chana, garbanzo etc., is one of the most important pulse crops of India and is considered as "king of pulses" (Bhatt and Patel, 2001). India accounts for 68 per cent of total global output of chickpea and incidentally it is one of the largest consumers. Chickpea is grown in about 8.68 million hectare in India with tentative production of 5.35 million tonnes. In 2010-11, the estimated production was about 8.25 MT, a record in the last 50 year. Four states *viz.*, Madhya Pradesh, Uttar Pradesh, Maharashtra and Rajasthan together contribute about 87 per cent of production from area. In Gujarat, area under chickpea has been reported 2.39 lakh hectares with total production of 2.73 lakh tones and productivity of 1139 kg/ha during *Rabi* 2011-12 (DOAC, 2013).

Chickpea is an important source of dietary protein for human consumption and when the seeds are inoculated with *Rhizobium*, its growth is enhanced, and it's yield increased and there is a suppression of pathogenic fungi (Verma *et al*., 2010). The productivity of chickpea crop has not witnessed any significant jump

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as compared to the cereal crops, because of several biotic and abiotic constraints. Among the many biotic factors responsible for low yield, damage due to insect pests is the major limiting factor (Bhagwat *et al*., 1995). Chickpea crop is attacked by nearly 57 species of insect and other arthropods in lndia (Lal, 1992). Among them, pod borer *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is most important and accounts for about 90 to 95 per cent of the total damage caused by all the insect pests (Sachan and Katti, 1994 and Shrivastava and Shrivastava, 1990). This pests is popularly known as "gram pod borer", while in the U.S.A., it is called "bollworm" or "American bollworm" or "Corn worm". Synonyms of gram pod borer *Heliothis armigera* (Hubner) reported by Singh *et al.* (1989) are as *Heliothis obsoleta* Fabricius, *Helicoverpa armigera* (Hubner), *Chloridae armigera* (Hubner) and *Chloridae obsoleta* Fabricius. It has been reported 3.6 - 72.8 per cent pod damage in chickpea (Patnaik *et al.,* 1991). It is a very serious pest and has assumed the status of national pest in India.

Due to its high fecundity, migratory behaviour, high adaptations to various agro climatic conditions and development of resistance to various insecticides, it causes damage to various crops. It has become increasingly important and more acute in northern states of India (Jadhav *et al*., 1999). Chickpea is the most preferred host of this species which suffers losses to the tune of 25-70 per cent (Tripathi and Sharma, 1984). To combat this pest, till now the thrust was given mainly on chemicals, however, their indiscriminate use resulted in the development of resistance, resurgence and environmental pollution (Armes *et al*., 1992). So, this study was aimed at understanding the ecology and population dynamics of the pod borer through the cropping seasons to understand and possible response of the pest to changing climatic conditions.

MATERIAL AND METHODS

This experiment was conducted with chickpea [varieties *viz.,* V_1: GG-1 (popular), V_2: JG 16 (popular), V_3: ICCL-86111 (resistant) and V_4: L-550 (susceptible)] during 2011-2013, in the plot size 10.00 x 10.00 m with spacing of 45 cm between two rows. Details of treatments were : T_1= D_1V_1, T_2= D_1V_2, T_3= D_1V_3, T_4= D_1V_4, T_5= D_2V_1, T_6= D_2V_2, T_7= D_2V_3 and T_8=D_2V_4, where, D_1: Normal sowing *i.e.* 1st week of November, D_2 : Late sowing *i.e.* 1st week of December, V_1 : GG-1 (Popular variety), V_2: JG 16 (Popular variety), V_3: ICCL-86111 (Resistant variety) and V_4: L-550 (Susceptible variety). Five quadrates each of 10.0 x 2.0 m were taken in large plots, five plants were randomly selected from each quadrate and larval population (*Helicoverpa*) *i.e.* No. of *Helicoverpa* larvae/mrl (meter row length) at fortnightly interval, pod damage on five plants and seed yield / plot was recorded. Five pheromone traps were placed around the experimental plots, septa were changed every month and trapped male moths were counted at weekly interval *i.e.* no. of *Helicoverpa* male moths/trap/ week.

RESULTS AND DISCUSSION

For the incidence of insect pests and monitoring of pod borer moths in chickpea data presented in Table 1 to 4 and results are presented under following headings.

Incidence of insect pests :

Larval population of *H. armigera* was found significant in individual years but in pooled results it was found non-significant and it varied from 0.86 to 2.55 larvae/mrl at 30 DAS. More or less similar pattern was observed at 45 and 75 DAS, where larval population varied from 1.45 to 3.20 and 1.26 to 3.02 larvae/mrl, respectively. At 60 DAS larval population was found significant in individual as well as pooled results, the treatment D_2V_1 noted lowest larval population (0.58 larvae/mrl) and it was at par with most of the treatments except D_1V_4 and D_2V_4 with susceptible variety (L 550).

Pod damage :

D_1V_3 recorded the lowest pod damage of 3.66, 3.95, 4.03 and 3.88 per cent in 2011-12, 2012-13, 2013-14 and pooled results, respectively. It was at par with the treatment D_1V_2 (4.50%) and D_2V_3 (5.16%).

Seed yield :

Seed yield was found significant in individual years, but in pooled results it was found non-significant and it varied from 825 to 1612 kg/ha.

Male moths catch :

The activity of male moths began from 50th standard week of December to 9th standard week of February/ March. The peak period was observed from 1st standard week to 4th standard week of January. The maximum male moth trapped at 1st standard week of January.

Table 1 : Number of *Helicoverpa* larvae/mrl at 30 and 45 DAS

Treatments	No. of *Helicoverpa* larvae/mrl							
	30 DAS				45 DAS			
	2011-12	2012-13	2013-14	Pooled	2011-12	2012-13	2013-14	Pooled
D_1V_1	1.70 (2.38)	0.91 (0.34)	1.02 (0.54)	1.21 (0.96)	1.86 (2.97)	1.19 (0.92)	1.75(2.56)	1.60 (2.06)
D_1V_2	1.75 (2.55)	1.04 (0.59)	0.71 (0.00)	1.17 (0.86)	1.96 (3.35)	1.12 (0.76)	2.07 (3.79)	1.72(2.45)
D_1V_3	1.81 (2.76)	1.52 (1.82)	1.02 (0.54)	1.45 (1.60)	1.48 (1.70)	1.37 (1.37)	1.70 (2.38)	1.52 (1.80)
D_1V_4	1.91(3.14)	2.04 (3.64)	1.30 (1.18)	1.75 (2.55)	1.92 (3.19)	1.64 (2.19)	2.21 (4.39)	1.92 (3.20)
D_2V_1	1.55 (1.92)	1.99 (3.48)	1.51 (1.78)	1.69 (2.34)	1.26 (1.10)	1.91 (3.13)	1.02 (0.54)	1.40 (1.45)
D_2V_2	0.99 (0.47)	1.99 (3.48)	0.91 (0.34)	1.30 (1.19)	1.26 (1.10)	1.57 (1.97)	1.15 (0.82)	1.33 (1.26)
D_2V_3	1.02 (0.54)	2.87 (7.75)	0.71 (0.00)	1.53 (1.85)	1.26 (1.10)	1.74 (2.53)	1.19 (0.92)	1.40 (1.46)
D_2V_4	1.60 (2.07)	2.91 (7.94)	1.58 (2.00)	2.03 (3.62)	1.34 (1.28)	1.75 (2.58)	1.64 (2.19)	1.58 (1.98)
T								
S.E.±	0.13	0.17	0.08	0.29	0.14	0.13	0.13	0.21
C.D. (P=0.05)	0.38	0.49	0.23	NS	0.41	0.38	0.38	NS
C.V. %	19.02	19.97	16.11	19.52	20.43	18.93	18.65	19.34
Y								
S.E.±				0.18				0.13
C.D. (P=0.05)				0.55				NS
YXT								
S.E.±				0.13				0.13
C.D. (P=0.05)				0.37				0.38

$\sqrt{X+0.5}$ Transformation used, Data in parentheses are retransformed values, NS=Non-significant

Table 2 : Number of *Helicoverpa* larvae/mrl at 60 and 75 DAS

Treatments	No. of *Helicoverpa* larvae/mrl							
	60 DAS				75 DAS			
	2011-12	2012-13	2013-14	Pooled	2011-12	2012-13	2013-14	Pooled
D_1V_1	1.64 (2.19)	1.90 (3.11)	0.91 (0.34)	1.48 (1.70)	1.02 (0.54)	1.84 (2.89)	1.12 (0.76)	1.33 (1.26)
D_1V_2	1.57 (1.96)	1.83 (2.84)	1.30 (1.18)	1.56 (1.95)	1.19 (0.92)	1.78 (2.68)	1.02 (0.54)	1.33 (1.27)
D_1V_3	1.09 (0.69)	2.54 (5.94)	1.02 (0.54)	1.55 (1.90)	1.02 (0.54)	2.04 (3.68)	1.22 (1.00)	1.43 (1.54)
D_1V_4	1.50 (1.74)	3.01 (8.55)	1.37 (1.37)	1.96 (3.33)	1.30 (1.18)	2.66 (6.56)	1.51 (1.78)	1.82 (2.82)
D_2V_1	0.91 (0.34)	1.39 (1.44)	0.81 (0.16)	1.04 (0.58)	1.19 (0.92)	1.63 (2.14)	2.25 (4.56)	1.69 (2.35)
D_2V_2	1.02 (0.54)	2.01 (3.54)	1.12 (0.76)	1.38 (1.41)	1.22 (1.00)	1.51 (1.78)	2.45 (5.50)	1.73 (2.49)
D_2V_3	0.91 (0.34)	1.39 (1.44)	1.12 (0.76)	1.14 (0.81)	1.02 (0.54)	1.68 (2.31)	2.35 (5.04)	1.68 (2.33)
D_2V_4	1.22 (1.00)	2.26 (4.59)	1.58 (2.00)	1.69 (2.35)	1.37 (1.37)	1.57 (1.96)	2.69 (6.74)	1.88 (3.02)
T								
S.E.±	0.11	0.16	0.10	0.18	0.11	0.14	0.12	0.28
C.D. (P=0.05)	0.32	0.46	0.28	0.55	NS	0.42	0.34	NS
C.V. %	20.18	17.33	18.76	18.92	21.98	17.49	14.35	17.48
Y								
S.E.±				0.11				0.17
C.D. (P=0.05)				0.34				0.52
YXT								
S.E.±				0.12				0.13
C.D. (P=0.05)				0.35				0.35

$\sqrt{X+0.5}$ Transformation used, Data in parentheses are retransformed values, NS= Non-significant

Patnaik and Senapati (1996) observed that the larval activity peaked between the 50th and 2nd standard weeks (*i.e.* 2nd week of December to 2nd week of January). Almost same observation was noticed by Jadhav and Suryawanshi (1998) and Tripathy *et al*. (1999). Thus, the present observations on incidence of *H. armigera* on chickpea crop are more or less in accordance with the earlier reports.

Conclusion :

It is revealed from the pooled data that at 30, 45 and 75 DAS, there was no substantial population of *Helicoverpa armigera* as crop was in vegetative and matured pod stages, respectively. Both these life stages

Table 3 : Effect of different treatments on pod damage seed yield of chickpea

Treatments	Pod damage (%)				Yield (kg/ha)			
	2011-12	2012-13	2013-14	Pooled	2011-12	2012-13	2013-14	Pooled
D_1V_1	12.94 (5.01)	15.02 (6.71)	14.92 (6.63)	14.29 (6.09)	1248	1132	1016	1132
D_1V_2	11.20 (3.77)	10.45 (3.29)	15.08 (6.77)	12.24 (4.50)	1176	1800	1860	1612
D_1V_3	11.02 (3.66)	11.47 (3.95)	11.58 (4.03)	11.36 (3.88)	1156	1346	1066	1189
D_1V_4	17.72 (9.27)	17.72 (9.26)	17.81 (9.36)	17.75 (9.30)	1256	564	898	906
D_2V_1	14.28 (6.09)	14.81 (6.53)	14.64 (6.39)	14.85 (6.33)	1146	1290	900	1112
D_2V_2	12.04 (4.35)	17.16 (8.71)	14.83 (6.55)	14.68 (6.42)	1170	1814	1158	1381
D_2V_3	13.55 (5.49)	14.99 (6.69)	10.84 (3.54)	13.13 (5.16)	986	1140	1524	1217
D_2V_4	17.64 (9.19)	20.52 (12.29)	17.47 (9.01)	18.54 (10.11)	1120	580	774	825
T								
S.E.±	1.12	0.91	0.87	0.91	4.79	9.72	8.18	17.19
C.D. (P=0.05)	3.25	2.65	2.51	2.75	13.88	28.15	23.69	NS
C.V. %	18.21	13.40	13.26	14.97	9.26	17.99	15.91	14.96
Y								
S.E.±				0.56				10.52
C.D. (P=0.05)				NS				NS
YXT								
S.E.±				0.98				7.84
C.D. (P=0.05)				2.75				22.08

Arcsine transformation used, Data in parentheses are retransformed values NS= Non-significant

Table 4 : Number of male moths catched /trap/week

Std. week and month		2011-12	2012-13	2013-14	Average
49	December	0.00	0.00	0.20	0.07
50	December	0.00	0.40	3.40	1.27
51	December	1.20	0.60	0.80	0.87
52	December	2.60	0.40	0.60	1.20
1	January	2.60	23.80	10.80	12.40
2	January	4.60	7.00	4.20	5.27
3	January	3.00	6.00	5.60	4.87
4	January	4.60	6.00	7.00	5.87
5	Jan/Feb	1.60	2.60	3.20	2.47
6	February	5.40	2.60	3.00	3.67
7	February	13.40	0.80	2.60	5.60
8	February	4.40	2.40	1.60	2.80
9	Feb/March	4.20	3.00	1.00	2.73
10	March	1.60	1.00	1.00	1.20

of crop did not supported the growth of *Helicoverpa armigera*.

The results obtained at 60 DAS revealed that lowest larval population of *Helicoverpa armigera* in D_2V_1 (0.58 larvae/mrl) which was at par with most of the treatments except D_1V_4 and D_2V_4. This can also be supported by looking the pheromone trap catches of *Helicoverpa armigera* as well as pod damage.

So, it is informed that normal and late sowing and chickpea varieties other than susceptible one (L 550) showed sustainable population of *Helicoverpa armigera* at 60 DAS. So it is recommended to initiate integrated pest management strategies for the *Helicoverpa armigera* after 45 DAS to manage them effectively.

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